venous blood increases, the latter force becomes relatively more powerful." The most energetic of these auxiliary pneumatic forces is stated to be that of the chest, which is followed in importance by the suction force of the heart and by a "pleuro-cardiac pneumatic force," in which the heart, contracting in a rigid chamber, draws blood into it from the surrounding veins, on account of its decrease in size during the systolic act. The elaborate investigations of MM. Chauveau and Marey,* published a little more than ten years ago, put us in a position to state exactly, in inches of mercury, what are the values of the pneumatic forces which Dr. Buchanan describes; and as these results are evidently not familiar to British physiologists, to those at Glasgow at least, it may be worth while recapitulating them here. First, the sphygmograph trace in health shows that, as Dr. Arnott maintained, normal respiration has scarcely any appreciable effect on the blood-pressure, because the horizontal line joining corresponding points in the different pulse-beats is very nearly, if not quite, straight. These authors also explain how the antagonistic results of Ludwig and Vierordt—in which the one states that the blood-pressure falls during inspiration, and the other during expiration—can be accounted for; they finding that if the air-passages are partially obstructed, as by shutting the mouth and closing one nostril, the one result is produced; whilst if these same passages are freely opened, the opposite effect is observed. The influence of respiration may therefore be dismissed as comparatively insignificant.

That of the heart is much more considerable. By means of a beautifully constructed piece of apparatus M. Marey has been able to demonstrate the existence and amount of the negative or suction forces, as far as they are found to exist in the different cavities of the heart, during the different parts of each cardiac pulsation. His results are recorded by the graphic method,† and their agreement among themselves is evidence of their accuracy. The work referred to contains a full description of the apparatus employed. The following are the results:—In the right ventricle the blood-pressure does not ever go beyond zero, except at its basal portion, where it is *sometimes* found that a minute suction force develops immediately after the closure of the aortic valves, and then only. In the left ventricle an appreciable suction force is observed at the same time as in the right; it is, however, not great. It is impossible, by any means yet devised, to get at the left auricle, but the right auricle is easily arrived at from the jugular vein. In it the blood-pressure is *nearly always* negative or below zero, it being otherwise only during its systole. A study of the auricular cardiograph trace shows that immediately after the auricular systole, which is the same thing as saying at the commencement of the contraction of the ventricles, the pressure in the auricle descends rapidly below zero; that the descent is broken by a small wave, and that the suction force commences to diminish gradually after the closure of the aortic valve, becoming *nil* a very short time before that organ again contracts. The explanation of these changes is not difficult. The rapid fall in the auricular pressure during the ventricular contraction was many years ago fully explained in a peculiarly able memoir by Mr. Bryan,* and the active dilatation of the ventricles of the heart during diastole, which necessitates a corresponding internal suction force, has been shown by more than one physiologist to depend on the peculiarities of the coronary circulation.

By employing a specially adapted manometer M. Marey was able to measure this suction force in the right auricle of *Equus caballus*, and found that it ranges, on the average, between − 7 and − 15 millimetres of mercury, the same method giving 120 millimetres as the average pressure in the left ventricle during the systole. From these figures the true relation borne by the contractile force of the heart to its suction power can be readily estimated.

The "pleuro-cardiac pneumonic force" described by Dr. Buchanan is nothing more than that above referred to as described by Mr. Bryan, the latter author having previously demonstrated that on account of the heart—a conical organ—contracting in a conical cavity, it must necessarily advance towards the apex of that cone during systole, and so leave the base to be filled by the absorption of the blood from the distended veins.

These remarks all tend to show that many of Dr. Buchanan's investigations are in the right direction, but that a further acquaintance with the literature of the subject would enable him to employ his considerable ingenuity and enthusiasm in the elucidation of points still remaining unexplained to students of the science of physiology. This want of acquaintance with the works of others is, we think, partly explained by some incidental remarks in the book before us. The author says: "I have always exercised all the branches of my profession. . . . I cannot but regard this custom as much superior to that which our medical corporations are now enforcing, of making every man from the beginning select for himself a single branch of the profession;" to which are added other remarks derogatory to specialisation in study. With these we cannot agree, and still think that "if you wish to find a man of large views of physiological nature," he is more likely to be a special student, with time at his disposal, unoccupied by miscellaneous professional calls, than one who, turning his attention to all things, has no opportunity of concentrating it on any one, to the advancement of our knowledge of its details.

OUR BOOK SHELF

Elements of Animal Physiology. Elementary Science Series. By J. Angell. (W. Collins and Co., 1874.)

THERE is more than one way by which the relative importance of scientific facts may be arrived at. An investigator, whilst prosecuting his independent researches, will not be long in forming a fairly accurate standard, and this he finds it easy to impart to others. Many engaged in educational work find it impossible to afford the time for independent observation or prolonged study, and yet it is their ambition to give their pupils a fairly correct estimate as to those of the innumerable facts surrounding them on which they should lay stress in preparing for a pass examination. The standard with them therefore becomes nothing more nor less than the questions of former years or of other similar examinations; the work which answers the greatest number of these in the most satisfactory manner being looked upon as the most

* Marey, "Circulation du Sang;" Paris, 1863.
† *Loc. cit.* pp. 95, 96.

* *Lancet*, Feb. 8, 1834.

valuable, especially if the irrelevant matter is reduced to a minimum. The small book before us contains a carefully compiled and accurate digest of many of the most prominent facts of human physiology, with incidental references to some of the best known peculiarities of a few of the lower animals, illustrated by several appropriate and well-selected diagrams, among which, however, there is an important one indicating the general distribution of the arterial system, which is unfortunately reversed, and another explaining the leverages of the body, representing a man as standing with his centre of gravity far in front of the tips of his toes. The language employed is clear and concise, whilst many of the best known terms in common use among physiologists are explained in a glossary at the end of the book. Some of the practical illustrations suggested to the pupil for his own instruction are particularly to the point. There are some explanations with which, however, we cannot agree, such as that the activity of the circulation of the blood which accompanies physical exercise is the result of the alternate compression and relaxation of the veins; and that a much vaunted theory as to the cause of cholera, which involves the purchase of a much advertised apparatus for its relief, has sufficient foundation for even the slightest mention in any book for the use of students. The non-technical character of the work will commend it to many as a useful introduction to physiology.

The Gardener's Year Book and Almanack, 1875. By Robert Hogg, LL.D., F.L.S. (*Journal of Horticulture* Office.)

THIS is a very handy and valuable little book. The information it contains is of a kind that may be thoroughly depended upon. Besides a great deal of practical information of a miscellaneous sort, there are tolerably copious gardening directions for each month, besides selected lists of fruits and vegetables, and of the new plants of last year. It will be very useful to amateur gardeners, and would be still more so if it gave some short and plain descriptions of various horticultural operations—such, for example, as pruning different kinds of fruit-trees.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Absence of Microscopic Calcareous Organic Remains in Marine Strata charged with Siliceous Ones

IN a letter headed "Deep-Sea Researches," and subscribed "W. C. Williamson, Owens College," in your issue of the 24th Dec. (vol. xi. p. 148), the author, after having stated that Dr. Wyville Thomson has come to the conclusion that the calcareous Globigerinæ and other such elements had been removed by the "solvent action of carbonic acid accumulated in the deep-sea waters," adds that, "In my memoir [1847, *op. cit.*] I arrived at the same conclusion."

Then follow extracts from the "Memoir" itself, alluding to the removal of all the calcareous forms, leaving only the siliceous structures," by "carbonic acid gas in solution in water."

Finally, the author states:—"After venturing upon these conclusions in 1847, not as mere speculative guesses, but as the deliberate result of a long series of investigations carefully worked out, I need scarcely say how intense was the interest with which I read Dr. Wyville Thomson's observations, which so thoroughly sustain and confirm the accuracy of mine. My conclusions were wholly derived from the microscopic observations of earths and rock specimens which I compared with the few examples of foraminiferous ooze with which I was then familiar."

"Felix qui potuit rerum cognoscere causas."

In enumerating the different kinds of destruction which take place in sponge-spicules generally, I have noted that the calcareous spicule is subject to one in particular, "in which there is a general breakdown of the whole fabric, which gradually becomes resolved into a group of aqueous-looking globules, of different sizes, among which there is not a trace of the original structure to be seen. Were this change confined to those calcareous spicules which I have mounted in Canada balsam, I should have inferred that it was caused by the balsam; but I find that the same change accompanies these spicules where they may have been taken in by the keratacеous sponges to form an axis for their horny fibre; and it is worthy of remark that the spicules of the Echinodermata, which may lie side by side with them, do not appear to be similarly affected. Of what nature the origin of this disorganisation may be I am ignorant; it is a chemical question; but the destruction takes place so rapidly in many instances that I have for some time past ceased to mount any more calcareous spicules, and now preserve a record of them by immediate sketches." (Ann. and Mag. of Nat. History, vol. xii. 1873, p. 457.)

Thus it follows that a removal or an annihilation of the forms of these microscopic calcareous organisms takes place after they have been repeatedly washed in fresh water, dried under a great heat, and covered at the same time with balsam, that is, treated artificially; as well as naturally, when they are mixed up with other microscopic organisms to form the core of the horny fibre of marine sponges; while the same thing takes place with the Foraminifera, as testified by slides, in some of which fragments of *Operculina arabica* mounted upwards of twenty years ago have nearly all passed into dissolution, and others in which the spicules of calcareous sponges which were mounted not more than six years since have disappeared altogether, leaving nothing but a few aqueous-looking globules in their places respectively.

So that this dissolution may arise without the presence of "carbonic acid gas in solution in water;" and as it is common to the calcareous organisms mounted in balsam for the cabinet, as well as in the core of horny fibre in the marine sponges of the "deep-sea," we may fairly assume that the removal of the calcareous forms from the siliceous ones in marine deposits may be due to more causes than that assigned by the author of the letter to which I have alluded.

Moreover, even the siliceous spicules which form the core of the glassy fibre in the vitreous sponges may, with the circumjacent layers of the fibre itself, undergo absorption to such an extent, in the skeleton of these sponges, *after death*, as to leave nothing but a siliceous shell with hollow, continuous tube throughout.

Such are the results of my microscopic observations among these minute organisms, and therefore, in the concluding words of the letter under reference, "I think I am justified in wishing the fact to be placed on record."

Indeed, so common and rapid is the process of destruction or inherent disintegration among the microscopic calcareous organisms which I have mentioned, that I am compelled to the conclusion that it is to this chiefly, and not to "carbonic acid gas in solution in water," that we must look for a satisfactory explanation of the fact that minute calcareous organic forms are comparatively absent among the siliceous ones of marine deposits, both recent and fossilised.

The agency of decay is as difficult to comprehend as the agency of development (why we should die any more than why we should live); hence it becomes unphilosophical to limit the operations of either to any *one* process. All that appears certain in the matter is, that the *three* great attributes of the system, viz., creation, preservation, and destruction, form a cycle in which, to speak figuratively, the words "perpetual change" may be enwreathed. HENRY J. CARTER

Budleigh-Salterton, Dec. 26, 1874

The Constant Currents in the Air and the Sea

THE *Philosophical Magazine* for July, August, and September contains a memoir, continued through the several numbers, by Baron N. Schilling, Captain in the Imperial Russian Navy, on "the Constant Currents of the Air and the Sea." It appears that this memoir was first published in the Russian, afterwards in the German, and finally translated and published in the English language; so that it seems to be regarded as a memoir of considerable importance.

When any new and extraordinary results are obtained in any department of important scientific inquiry, the interests of science require that the basis of these results should be critically examined before they are received; and this is especially so where,